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The Business Structure of the 2030 IoT Market

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Introduction: The Next Step in Productivity

Over the past 20 years, the tech ecosystem has successfully moved office applications out of the desktop PC and into the Cloud. Examples include Salesforce.com, ConstantContact, Office365, and Zoom. The user's terminal can now be highly constrained: we can send a ConstantContact mailing from our smartphones without storing the mailing list or the images on the phone itself.

So, in the grand view of the tech markets, we have now reached a pinnacle of sorts, in terms of office productivity. We can communicate in many ways with other workers seamlessly, anywhere, and with very limited handheld platforms.

Where do we go from here? Sure, there will be ongoing development to make the Cloud office apps easier to use. But the major value in office automation has already been captured. The next trillion-dollar company will add value in a different market altogether.

We believe that the "Next Big Thing" will be a shift in focus from office automation to the automation of physical things. Enterprises have driven the evolution of office systems quickly because almost all offices do the same things: They write documents, they analyze numbers on spreadsheets or databases; they track contacts and sales leads; they account for income and expenses. Most of the good stuff has been achieved already: in fact, office productivity growth has slowed down recently in many countries. As ongoing improvements in office productivity slow down, we expect the enterprise to turn its attention to automating actual work.

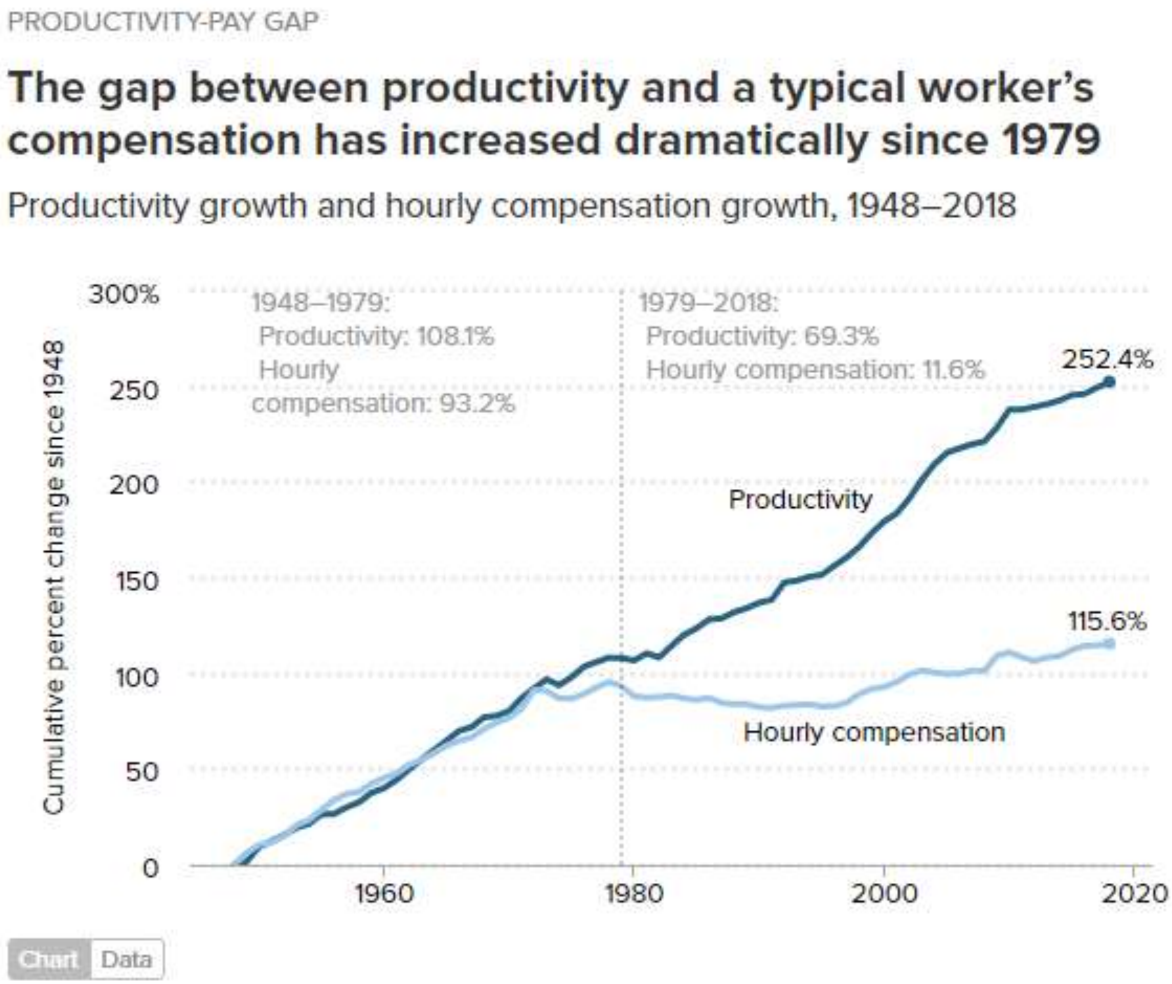

Figure 1: Long-term trend in Productivity

Sources: Economic Policy Institute

Roughly 60% of cost in a typical industrial business derives from some kind of physical activity: Manufacturing or processing a product, then testing the product, packaging the product, and moving it around. Only 40% of costs are related to the white-collar jobs that deal with information. Therefore there's a high demand for automation in the physical world. Manufacturing has embraced this concept for many years, with robotics that enhance the productivity of each worker. But we still use human fork-lift operators and humans perform visual inspections of products. Most products worldwide are still packaged and shipped by human hands.

In the big picture, we believe that technology has reached a level of maturity which allows for much greater automation for these functions. Cheap cameras make excellent sensors, when used with Edge Computing analytics and Machine Learning.

What's Preventing Rapid Growth in Industrial Automation

Only three years ago, industry pundits were predicting 50 billion IoT devices by 2020. Mobile Experts never agreed with this… and our conservatism has been proven correct, as 2020 is only 2 months away and the installed base of IoT devices stands at only 4 billion devices. (By the end of 2020 we predict 4.6 billion devices in active service)

Why?

In our view, it's not the connectivity that is holding the industry back. Interfaces such as Ethernet and Fieldbus have provided low-latency, high-speed connectivity for 20 years using wires, and businesses have used them widely for automation of basic functions on robotics and large machinery. And new connectivity such as LTE-M or NB-IoT is coming into the market nicely for applications that don't require low latency or high bandwidth.

Instead, we believe that industrial automation has only focused on about 10% of the possible use cases because the ROI of automating other functions has not been as obvious to them. We've automated the welding in an automotive manufacturing plant. But small enterprises have not automated the packing/shipping of small products because it's cheaper to pay people instead of investing millions to invent a packing/shipping machine.

The poor ROI comes from multiple factors:

1. The manual activity in question requires flexible sensing of the environment and the product itself, judgment, and some physical movement. This implies a need for sensors, a computing platform for Artificial Intelligence and Machine Learning, as well as robotics. All this sounds pretty expensive to a mom-and-pop manufacturing company or a local hardware store.
2. Physical movement (such as robotic manufacturing or packing a widget into a box) requires real-time decision making. The sensors may detect an obstacle or safety hazard, and the robotics must react quickly. Cloud-based automation does not lend itself to real-time computing.

3. Every business has a slightly different need, so each of these automated systems is different. The customization of sensors, AI, and robotics can be prohibitively expensive for any small company to tackle. That's why almost all of the sophisticated automation that we see takes place in large companies with billion-dollar product flow.

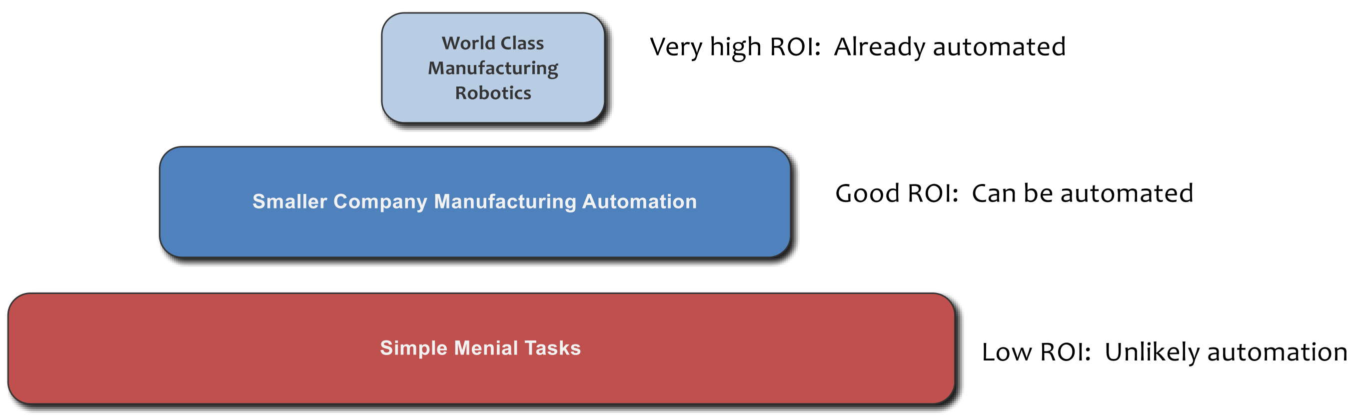

Figure 2: Market tiers in industrial automation

Sources: Mobile Experts

Parallels between Cloud-based Office Automation and Edge-based Industrial Automation

Today's situation in industrial automation reminds us of the early days of office automation. In the 1980s, each small company worked with a customized inventory database or sales database using some kind of home brew. The user interfaces were klunky and human experts emerged with arcane knowledge about how to navigate the computing environment. But in the 2010s, Cloud-based databases and tools emerged to make inventory management, accounting, marketing, and other functions more intuitive and easy-to-use.

The Cloud office tools were possible because the Cloud providers created a platform with open APIs, so that app developers could address specific business areas. Instead of a desktop PC with various Excel sheets to track inventory, sales forecasts, and accounting, we moved to Cloud apps that specialized in each area. One company emerged with the "best" implementation of a sales database (Salesforce.com). Another company emerged with the "best" email marketing platform (ConstantContact). And so on.

That's what is missing in the area of industrial automation. There's no platform for an app developer to specialize in a specific type of machine, making automation and customization of that machine easy for a non-technical user. So, in this way, today's environment for physical automation is parallel to the 2002 environment for office automation: Everybody developed their own system on separate platforms and investment in highly efficient automation was very expensive.

How to Build an Edge Cloud environment for flexible customization in thousands of different business areas

So, we need a platform that opens up automation, as Cloud Computing opened up the possibilities in office automation. In the case of physical activities, the Cloud won't work on its own because the Cloud cannot support the real-time decision-making that is required.

Step One: Put Edge Computing hardware closer to the action. This fundamental step is necessary to eliminate the latency involved in transporting data around. We've covered this step extensively so we won't dwell on it here.

Step Two: Create an Edge Computing software layer that allows open APIs for a wide variety of algorithms and applications to run. Amazon's Cloud enabled Salesforce.com to develop a database to share information and make salespeople more efficient. In the case of robotics, the Edge Computing software will create an operating layer where a specialized application can run, relying on the Edge Computing platform to coordinate with the central Cloud for algorithm training and to gather insights from other similar implementations of each application. In this way, each user of the application gets the benefit of 'learning' from all other users.

Step Three: Develop the apps for specific industrial tasks. This will be highly fragmented. Some very specialized, niche tasks (such as restoring delicate art work) may never be automated, because each daily task is different. But any task which is similar from one company to another can be automated. For example, suppose that a million tailoring shops want to automate the process of sewing clothing. When we have an Edge Computing platform that provides an easy-to-use API, a sewing-machine manufacturer could create an easy-to-use machine to measure the customer,

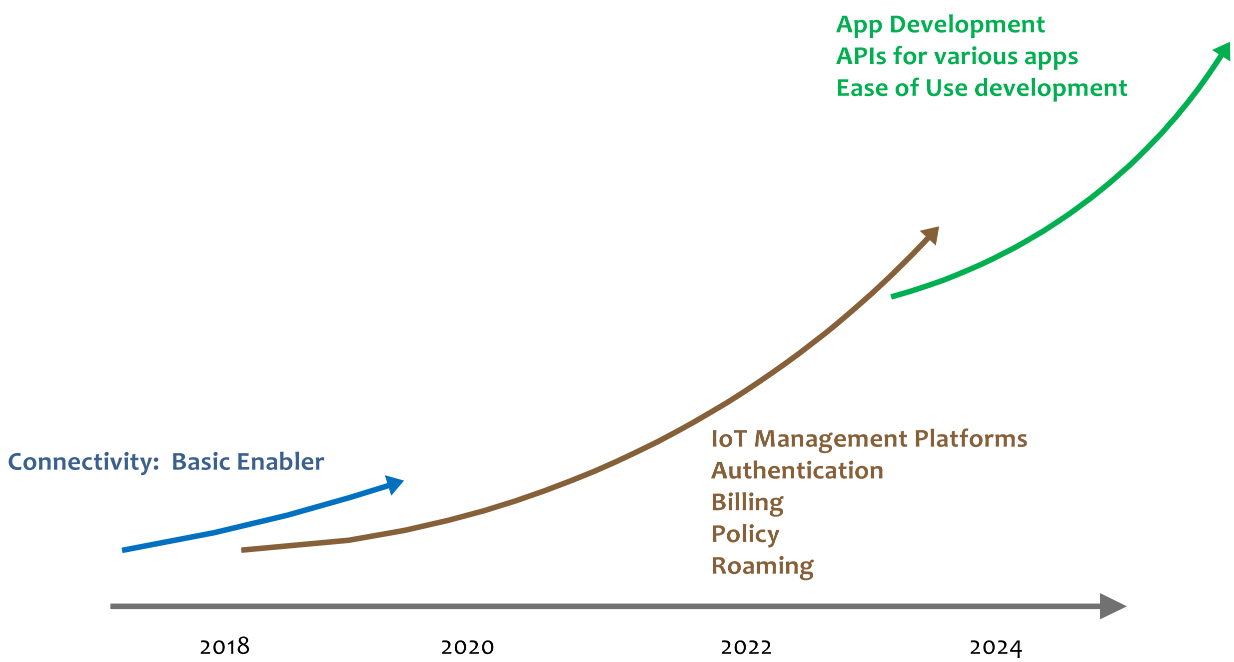

Figure 3: Steps to Industrial IoT Market Development

Sources: Mobile Experts

Market Development: It won't happen all at once

The initial market will, of course, be dominated by large enterprises with billion-dollar ROI. The on-premises use cases we have encountered in manufacturing, oil & gas refining, and transportation hubs are examples where a giant enterprise has invested heavily to create a custom MEC platform, new software, and matching robotics.

However, we believe that the market will mature over time, with the library of open APIs growing from the giant high-dollar apps toward new applications over time. When the MEC hardware platforms are in place in regional data centers (with, say 50 ms latency or less for simple analytics), we can expect facial recognition or license-plate reading to become more automated. Then, as the MEC investments move to the far edge (20 ms decision latency or less), we can expect simple things like tailoring or tire replacement to become more automated.

Figure 4: Automated heavy-truck tire replacement

Sources: Greg Smith Equipment

The Market will be segmented: Big Companies and Smaller Companies

Fortune 500 companies generally develop their own systems, control their own servers, and retain an IT staff to keep up with security updates and other changes over time. Small companies don't do that….the investment is too large and they can't be sure that they will adequately keep up with the patches and security threats that exist out there.

Similarly, in Industrial Edge Computing we can expect that big companies will want to control their data, and to keep the entire system within their security firewall. Smaller companies will be happy to use an external service that relies on Edge Cloud resources and provides them with an external real-time service. In this way, the market will begin (in fact it has already begun) to service large companies with On-Premises Edge Computing, while MEC over a public network will rise over the longer term.